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Clinical evaluation of specific oral and salivary findings of coeliac disease in eastern Turkish paediatric patients

ABSTRACT

Aim *The aim of this study was to evaluate whether enamel defects (EDs), recurrent aphthous stomatitis (RAS) and salivary findings in Eastern Turkish children with coeliac disease (CD), and to compare the results with healthy children.*

Materials and methods *Study Design: 70 children (35 CD patients and 35 healthy patients) aged between 5 to 15 years were included in this study. Intraoral examination was performed; saliva specimens were collected for analysis. Oral health conditions, tooth brushing frequency, saliva pH level, flow rate and buffering capacity were recorded. Kruskal-Wallis test was used for comparison of DMFT and dft index. Chi-squared test was used for the data of oral health status. The significance level was set at p= 0.05.*

Results *EDs were seen in 54.3% (19 patients) of the CD patients and more frequently than the controls ($p < 0.05$). Regarding RAS, 31.4% (11 patients) of the CD patients and none of control group had aphthous ulcers ($p < 0.05$). Salivary flow rate and buffering capacity were lower in CD patients ($p < 0.05$).*

Conclusion *The oral examination could be a significant contribution to the detection of CD. Especially paediatric dentists can play an important role in the early diagnosis and may help paediatricians about CD.*

Keywords *Caries; Coeliac disease; Enamel defects; Paedodontics; Recurrent aphthous stomatits; Saliva.*

Introduction

Coeliac disease (CD) is defined a lifelong intolerance as immune responsiveness to ingested gluten (such as wheat, rye, and barley) in genetically susceptible subjects [Campisi et al., 2007; Ortega Paez et al., 2008; Pastore et al., 2008]. Chronic diarrhoea, tiredness, abdominal distension and bloating, vomiting, weight loss, muscle weakness and loose stools are the characteristic clinical features [Leeds et al., 2008]. There is severe atrophy of the mucosa of the upper small intestine and the accurate diagnosis can be verified by intestinal biopsy [Campisi et al., 2007]. The prevalence of the CD of North America and Western Europe is close to 1% [Pastore et al., 2008]. This prevalence in children between 2.5 and 15 years of age is approximately 1:300 to 1:80 [Procaccini et al., 2007; Wierink et al., 2007]. In Turkey, the prevalence of CD was found to be 1:115 [Ertekin et al., 2005].

Osteoporosis, endocrinopathies, sterility, neurological and psychiatric disturbances, hepatic diseases, and association with autoimmune diseases (herpetiform dermatitis, diabetes mellitus, selective IgA deficiency, and thyroid diseases) may occur when CD is not treated [da Silva et al., 2008]. So early diagnosis and a gluten-free diet treatment are very important [Sedghizadeh et al., 2002].

CD presents oral findings because the oral cavity represents the first part of the gastrointestinal tract. Some reports suggested an association between CD, enamel defects (EDs) and recurrent aphthous stomatitis (RAS) [Campisi et al., 2007; Pastore et al., 2008; Procaccini et al., 2007; Bucci et al., 2006]. Therefore, the aim of this study was to investigate the prevalence of specific EDs, RAS, caries experience (DMFT and dft indices), and oral hygiene habits and to measure saliva pH, salivary flow rate, and buffer capacity in children.

Materials and methods

The study group consisted of 35 patients who had been endoscopically diagnosed with coeliac disease, who were seen at the Department of Paediatric Gastroenterology, Hepatology and Nutrition, Atatürk University Medical School, Erzurum, Turkey. This study was approved by the Ethics Committee of the Ataturk University Institute of Health Sciences, Erzurum, Turkey. The study group of patients had no history of antibiotic treatment in the last 2 weeks before oral examination. Thirty-five healthy patients comprised the control group. They also had no history of antibiotic treatment in the past 2 weeks. Patients with following diseases, which often present oral manifestations like CD were excluded: Behcet's syndrome, diabetes mellitus, immunodeficiency, Reiter's syndrome, Crohn's disease, ulcerative colitis, deficiency of A, B12, C, or D vitamins, lichen planus, syphilis, endocrine pathologies. In addition, all CD patients were

not following a gluten free-diet. CD patients, who had previously followed a gluten-free diet for a period of one year or more, were excluded from this study. The patients included in this study ranged from 5-15 years. A standard protocol was employed that included variables such as name, age, gender, socio-demographic status, nutritional and tooth brushing habits, oral examination and salivary parameters.

Oral examination

The oral examination was carried out at the clinic with a mouth mirror and probe under artificial light using the WHO criteria (dft and DMFT indices) [Davies and Barmes, 1976]. The oral examination included assessment of dental caries, oral hygiene status, plaque index. In addition, information on tooth brushing, nutritional habits and salivary pH, buffer capacity and flow rate were collected. Oral hygiene status was assessed and classified as good, fair or poor using the oral hygiene index of Green and Vermillion [1964]. The EDs were recorded according to Aine's classification [1986]; Aine first described dental enamel defects in children that are exclusively related to CD. These specific enamel defects have to be symmetrically and chronologically detectable in all four sections of the dentition. Other enamel defects (discolorations, hypoplasia, or opacities) that are not symmetrical and chronological and that do not affect the same teeth in both hemiarches are considered unspecific. Dental examination was performed by one examiner (A.D). Before the examination of EDs and caries, the teeth were brushed with a prophylaxis paste, then washed and dried. The soft tissues were examined for the diagnosis of RAS and patients also were asked about the recurrence of oral ulcers. The analysis of saliva was performed by using Saliva-Check Buffer (GC Corp, Japan); patients chewed paraffin wax for 5 min, and the stimulated saliva was collected into sterile tubes; then the saliva flow rate was recorded, <3.5 ml was classified as very low, 3.5-5 ml as low, and > 5 ml as normal. Similarly, buffer capacity was recorded with the same test. Sufficient saliva was dropped onto the test pads by using a pipette. The buffer capacity was calculated according to the change in colour of the test pads: a score of 0-5 points was classified as very low, 6-9 points as low, and 10-12 points was classified as normal/high. The measurement of salivary pH was carried out with a pH test strip placed into the saliva sample for 10 s. The change in the colour of the strip was compared with the testing chart in the package.

Dental plaque index was scored according to Silness and Löe [1964]: 0 = no plaque in the gingival area; 1= a film of plaque adhering to the free gingival margin and adjacent area of the tooth; 2= moderate accumulation of soft deposits within the gingival pocket, on the gingival margin and/or adjacent tooth surface, which can be seen with the naked eye; 3= an abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface. For the appropriate statistical analysis we considered a plaque score of 0.1-1.0 = mild, 1.1-2.0 = moderate, and 2.1-3.0 = severe.

All patients were asked about their oral health behaviour including tooth brushing habits.

Statistical Analysis

The data were analysed using the SPSS for Windows (Release 18.0) statistical software. The Kruskal-Wallis statistical analysis was used for comparison of the DMFT and dft index. The Chi-square test was used to analyse the data of oral health status, where p values of <0.05 were regarded as statistically significant.

Results

The study group consisted of 35 patients, 18 females and 17 males, aged between 5-15 years, with a mean age of 9.71 ± 2.49 years. The control group comprised 35 patients, 17 females and 18 males, aged 5-15 years, with a mean age of 9.57 ± 2.40 years.

EDs were observed in 54.3% (19 subjects) of the CD patients versus 20% of the controls ($p < 0.05$) (7 subjects) (Table 1). EDs were observed significantly more often in CD patients than controls. Severity score of EDs, 14 CD patients showed lesions of Grade 1 and 5 patients Grade 2; in controls 6 of them Grade 1 and 1 patient Grade 2. Eight CD patients with enamel defects were males and 11 were female, while in the control group 2 patients were males and 5 were females. There was no significant difference between CD and control group in terms of sex distribution ($p > 0.05$) (Table 1).

Based on the oral examination, 31.4% (11 subjects) of CD patients had aphthous ulcers, while none of the control group was affected. RAS was statistically higher in patients with CD ($p < 0.05$).

DMFT and dft scores of CD children were 4.74 ± 3.46 and 2.63 ± 3, while in the controls DMFT and dft scores were 4.71 ± 1.9 and 2.3 ± 2.0, respectively. These results were statistically insignificant ($p > 0.05$).

Twelve (34.3%) CD patients had good oral hygiene compared to 5 (14.3%) among controls. The observed difference in the oral hygiene status between the two groups was not statistically significant ($p > 0.05$). In the CD group, mild dental plaque accumulation was detected in 17 (48.6%), moderate in 6 (17.1%) and severe in 6 (17.1%) patients. In the control group, mild dental plaque accumulation was detected in 14 (40%), it was moderate in 12 (34.3%) and severe in 6 (17.1%) patients, while 3 controls (8.6%) exhibited no plaque. There was no significant difference between the two groups in terms of plaque indices ($p > 0.05$) (Table 2). Four coeliac patients (11.4%) hardly ever brushed their teeth and 12 patients (34.3%) reported irregular tooth brushing. In the control group, 14 patients (40%) reported irregular tooth brushing, 10 of them (28.6%) brushed their teeth

once a day, 7 of them (20%) twice a day, and 4 patients (11.4%) hardly ever brushed their teeth. The difference between the two groups was not statistically significant ($p > 0.05$) (Table 3). The pH levels in the two groups were found to be "normal". In the CD group, 9 children (25.7%) were found to have very low salivary flow rates, whereas 1 control (2.9%) had a very low flow rate ($p < 0.05$). In the coeliac group, 4 children (11.4%) had normal buffering capacity, while 30 controls (85.7%) had normal buffering capacities. The difference between the groups was statistically significant for salivary flow rates and buffering capacity (Table 4).

Discussion

Some oral manifestations such as EDs and recurrent mouth ulcers may help to identify CD patients [Campisi et al., 2008]. The prevalence of EDs of permanent teeth in children with CD was 95.94% in Aine's study, subsequently the author provided the strongest evidence that EDs may be an additional intestinal manifestation of CD [Aine, 1986]. In our study, the prevalence of EDs in Turkish children was 54.3%, which is in line with the literature [Pastore et al., 2008; Bucci et al., 2006; Avsar and Kalayci, 2008]. We found a significant difference between CD patients and healthy controls in terms of prevalence of EDs. The aethiology of dental enamel defects associated with CD is unclear. [Campisi et al., 2007; Pastore et al., 2008; Wierink et al., 2007] There are some hypotheses about the mechanism of EDs.

1. Hypocalcaemia-malabsorption: hypocalcaemia caused by malabsorption during enamel formation is a specific cause of enamel hypoplasia [Campisi et al., 2007; Pastore et al., 2008; Wierink et al., 2007; da Silva et al., 2008].
2. Autoimmune response: a gluten-induced immune-mediated process may occur between 6 months and 7 years in the enamel-producing organ, resulting in defective enamel formation [Aine, 1986; Maki et al., 1991].
3. A specific antigen, human leukocyte antigen (HLA), alleles DR3 and DQ2, is strongly associated with dental defects in CD patients, suggesting a genetic cause.Ortega Paez et al., 2008; Pastore et al., 2008; Procaccini et al., 2007; Wierink et al., 2007; da Silva et al., 2008].

In our study Grade 1 and Grade 2 enamel defects were the most common scores. In some studies [Lahteenoja et al., 1998: the authors also observed in Grade 3 and Grade 4 defects. The reason of this difference is not entirely clear. This may be associated with the clinical severity of coeliac disease [Cheng et al., 2010]. Regarding the oral soft tissue examination, we found that the prevalence of RAS was 31.4% in CD patients, while it was absent in the control group. There was a significant difference between the two groups, similarly

Parameters	CD patients (n=35)	Controls (n=35)	p value
EDs	19 (54.3%)	7 (20%)	$p < 0.05$
RAS	11 (31.4%)	0 (0%)	$p < 0.05$

TABLE 1 Comparison of celiac and control groups in terms of oral findings.

Pi	Coeliac		Controls		p value
	n	%	n	%	
0	6	17.1	3	8.6	
1	17	48.6	14	40	0.072
2	6	17.1	12	34.3	
3	6	17.1	6	17.1	

TABLE 2 Plaque indexes of patients.

Frequency of brushing	Coeliac		Controls		p value
	n	%	n	%	
Once a day	10	28.6	10	28.6	
Twice a day	9	25.7	7	20	0.072
Irregular	12	34.3	14	40	
None	4	11.4	4	11.4	

TABLE 3 Frequency of tooth brushing in the two groups.

pH	Coeliac		Controls		p value
	n	%	n	%	
Critical	0	0	0	0	0.364
Normal	35	100	35	100	
Saliva Flow Rate					
Very Low	9	25.7	1	2.9	0.001
Low	15	42.9	13	37.1	
Normal	11	31.4	20	60	
Saliva Buffer Capacity					
Very Low	14	40	0	93.3	0.000
Low	17	48.6	5	14.3	
Normal-High	4	11.4	30	85.7	

TABLE 4 Saliva parameters of patients group.

to previous reports [Campisi et al., 2007; Procaccini et al., 2007; Costacurta et al., 2010; Tosun et al., 2012]. However, other studies showed no significant difference in RAS in CD patients versus controls [Sedghizadeh et al., 2002; Bucci et al., 2006]. Sedghizadeh et al. stated that CD is a 'risk indicator', not a 'risk factor' for RAS. Contrary to this study all our patients have had no gluten-free diet (GFD), so CD may be a risk factor for RAS. One possible explanation of the relationship between coeliac disease and RAS is that oral aphts may be caused by iron, folic acid or vitamin B12 deficiency. A study found that untreated CD patients' serum iron, folic acid and vitamin B12 levels were generally low [Ciclitira et al., 1984].

Therefore, there is need for more comprehensive studies on RAS in CD patients. In the present study there was no significant difference between the two groups in terms of plaque index and this finding was similar to what reported by another study [Acar et al., 2012]. However Shteyer et al. [2013] found a statistically significant difference (lowest in the group of GFD) and argued that this may be due to a low-cariogenic diet. In our study there was no significant difference between the two groups in terms of DMFT and dft index scores, which is in agreement with other studies [Acar et al., 2012; Shteyer et al., 2013; Aguirre et al., 1997]. However surprisingly, there are studies that reported caries index values of CD patients lower than the control patients [Ortega Paez et al., 2008; Sezgin Bolgül et al., 2009; Priovolou et al., 2004; Fulstow, 1979]. This difference may be explained by a low-cariogenic and controlled diet and good oral care [Fulstow, 1979]. Contrary to these studies, Arslan et al. [2009] and Costacurta et al. [2010] found that DMFT values of CD patients are significantly higher than the controls. Researchers thought that in CD patients with reduced salivary flow rate and enamel hypoplasia htere is an increased risk for dental caries. In our study, a significant difference could not be found between the two groups in terms of tooth brushing habits, in line with the study of Avşar et al. [2008] that evaluated the socio-economic status and tooth brushing habits. To the best of our knowledge, there are few previous reports on the association of oral pH levels and CD. In the present study, we found no significant differences of saliva pH levels between the groups. If a pH meter was used, different results could be had been obtained. In our study, there was a significant difference for salivary flow rate between the two groups. However Acar et al. [2012] found that saliva parameters were similar in both groups but the cariogenic microflora, levels of salivary mutans streptococci, and lactobacilli were found to be significantly lower in CD patients than in the healthy group, which could be due to their low cariogenic diets. In addition, statistically significant differences were found in terms of the buffering capacity of saliva between CD patients and controls, being lower in the CD patients. This may be caused by the medical problems of CD patients. There are insufficient studies about the relationship between salivary parameters and CD, clearly indicating that further studies are needed. Caries risk level is increased in CD patients due to their low saliva buffering capacity.

Conclusion

CD has extensive clinical manifestations such as dental enamel defects and recurrent aphthous stomatitis is important for paediatric dentists. We think the oral examination could be a significant contribution to the detection of CD. Especially paediatric dentists can play an important role in early diagnosis. These patients should be included in a preventive dental programme due to their high caries risk. Patients should be given professional oral hygiene education, and pit and fissure sealants as well as topical fluoride applications should be done.

Conflict of interest

The authors declare no conflict of interest.

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